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IAP20 Rec'd DEPTD 19 JAN 2006OVERHEAD CONVEYOR

The present invention relates to overhead conveyors of the type that comprises at least one carriage which is drivably arranged in a superjacent girder system and from which load-holding means are suspended. In one embodiment, the drivable carriage is propelled by a threaded spindle which extends in the conveying direction and is adapted to cooperate with a driven part of the carriage. Such a conveyor gives a number of advantages of which the maybe most important one is that the available floor space need be used for the conveyor to a very small extent only.

However, it is a disadvantage that such conveyor tracks can only be arranged in a main direction, and branchings, curve portions etc often require manual actuation, which means that automation will suffer.

In an overhead conveyor according to SE 501,744 C2, it is possible to provide, without difficulties, automatic switch to branches, driving through sharp bends and even temporary disengagement from driving of individual movable carriages, and this is achieved by the spindle being provided with alternately threaded drive portions and smooth, non-driving portions, and by said movable carriages each consisting of two carriages combined to a unit, at a distance from each other corresponding to the length of the threaded portions of the spindle, whereby a unit consisting of two carriages, during driving, is in driving engagement with driving portions of the spindle adjacent to one of the two carriages included in the unit.

This construction has been found to function in a satisfactory manner, but owing to the presence of the driving helical spindle it constitutes a fairly expensive

solution while at the same time it is not particularly flexible.

The object of the present invention therefore is to provide an overhead conveyor that satisfies the positive features of the above-mentioned worm screw drive conveyor and besides is considerably less expensive and more flexible than this, which has been achieved by the overhead conveyor being given the features that are stated in claim 1.

10 The invention will now be described in more detail with reference to an embodiment which is schematically illustrated in the accompanying drawings.

Fig. 1 is a perspective view of a portion of the drive for the conveyor according to the invention.

15 Fig. 2 is a perspective view of a portion of a main girder included in the conveyor.

Fig. 3 is a perspective view of a movable drive carriage included in the conveyor.

20 Fig. 4 is a schematic cross-sectional view of a girder with drive belt and drive carriage.

Fig. 5 is a top plan view of a portion of a drive belt included in the conveyor.

25 Fig. 6 is a schematic cross-section of part of a girder with portions of two drive carriages disconnected from driving.

Figs 7a-c are end views of the main girder 9 included in the conveyor according to the invention, in different portions along the extent of the conveyor track.

30 Fig. 8 is a perspective view of part of the girder system of the conveyor to perform switching from the main track of the conveyor to a branch track, and

Fig. 9 is a schematic view of the design of a curve for a conveyor according to the invention.

35 Fig. 10 shows a carriage with an alternative embodiment of a driver.

Fig. 11 shows disconnection of the carriage in Fig. 10.

Fig. 12 shows a carrier with two different drivers.

Fig. 13 shows a driver involving another embodiment of a driver.

Fig. 14 shows disconnection of carriages according  
5 Fig. 13.

Fig. 15 shows a system of different types of drive element.

Fig. 1 is a perspective view of a portion of one embodiment of the drive of the conveyor according to the  
10 invention, schematically illustrating a drive motor 1 driving a first gear drive 2, which via a positive drive belt (not shown) transfers the drive force to a second gear drive 3, which in turn is non-rotatably connected to a drive and/or terminal roller 4, which drives an endless  
15 drive element in a driving run 5 and a return run 6. The drive element is here a drive belt which is kept tensioned by means of tensioning rollers 7. Alternative drive elements are chains, positive drive belts etc. This drive package is attached to a frame yoke 8 which is partially  
20 shown in the Figure.

Fig. 2 shows schematically a portion of an elongate girder 1 which is included in the inventive conveyor and which is designed as a hollow box girder 9 of square cross-section with a longitudinal, centrally arranged  
25 slot-like opening 10 which in the mounting position is positioned in the downwardly directed lateral surface. The frame yoke 8 supporting the motor (not shown) and the second lower gear drive 3 is fixed to the upper side of the girder 9. The frame yoke 8 straddles the girder 9,  
30 and the Figure shows a second similar frame yoke 11 fixed to the girder 9 in the axial direction after the first and, like this, provided with a gear drive 3 and drive and/or terminal rollers (not shown) and also a second endless belt loop. By arranging a positive drive belt  
35 between the two gear drives 3, the motor 1 can (according to Fig. 1) drive the first as well as the second belt loop. In this manner, it is possible to keep the length

of each belt loop within such limits as to make the slack thereof reasonable.

At the lower slot-like opening 10 in the girder there are arranged inwardly directed flange portions 12 which serve as rails for wheels of a drive carriage 13 schematically shown in perspective in Fig. 3, comprising a front carrier 14 and a rear carrier 15, which each in the shown example are provided with four wheels 16 which thus are to roll on the flange portions 12 shown in Fig. 2. Each of the front and rear carriers 14, 15 is provided with downwardly extending load carrier pins 17 which, when the drive carriage 13 is arranged in the girder 9, extend through the slot-like opening 10 and are interconnected by a frame 18 which in the shown example is quadrilateral, whereby the carriers 14, 15 are held at a constant distance from each other. Each carrier is also provided with a vertically arranged preloaded driver, here in the form of a finger or pin 19, the construction and function of which will be described in more detail below.

On the front carrier 14, the driver 19 is in its lower part provided with a partially ramp-shaped forwardly projecting driver plate 20. Both carriers 14, 15 are provided with guide rollers 21 which in the girder 9 rest against the inner wall thereof and thus prevent the drive carriage 13 from being set into lateral oscillations in the girder. In the rear part of the rear carrier 15 there is also arranged a pressing roller 22 adapted to cooperate with a carrier plate of a subsequent drive carriage in a manner that will be described in more detail below.

Fig. 4 is a schematic cross-section of a girder 9 where the driving run 5 of the drive element and its return run 6 are illustrated. The drive element, which here is a drive belt, is provided with a number of through holes 23 and the driver pin 19 of each carrier is arranged to extend through such a hole 23 in the lower driving belt run 5, whereby the entire drive carriage 13

will accompany the movement of the belt, until the driver pin is disengaged from the hole 23, whether this occurs by the belt reaching a terminal roller and thus being removed from its contact with the pin, or the pin 19 pretensioned by springs 24 is pulled downwards by being actuated by its driver plate 20. In the view shown, the girder is intended for a switch portion which will be described in more detail below and where the girder therefore is divided along a horizontal line 25. In the portion above this dividing line there are the belt runs 5, 6 and the drive rollers 4 and the gear drives 3 (not shown) while in the lower part there is the drive carriage 13 and its components. In this embodiment, belt supports 26, 27 for vertical guiding of the belt runs 5, 6 are arranged in the upper part of the girder 9.

Fig. 5 is a top plan view of a portion of the belt in Fig. 4, in which it is to be seen that the holes 23 therein are preferably not circular, but elongate and oval to provide greater flexibility when the driver pin 19 is to be engaged in a hole.

Fig. 6 is a schematic view of a girder 9 in which the front carrier 14 of a rear drive carriage 13 has caught up with a rear carrier 15 of an anteriorly situated drive carriage 13'. The anteriorly situated drive carriage 13' may have stopped because the driver pin 19 has been disengaged from the driving belt run 5. When the driver plate 20 of the rear drive carriage 13 reaches the pressing roller 22 of the anteriorly situated drive carriage 13', the spring bias of the driver pin 19 will be overcome and the pin moves downwards, so as to be disengaged from the drive belt 5. In this way, a number of drive carriages may be collected for shunting purposes, without requiring the belt drive to be stopped.

Fig. 7a is a cross-sectional view of an entire girder 9 with both runs 5, 6 of the drive belt and with a wheel 16 schematically shown in the lower part of the



girder. A girder of this cross-section is used for straight driven portions of the conveyor track.

Fig. 7b is a cross-section of an entire girder 9, which is divided in the manner illustrated in Fig. 4, said girder type being used at switching points.

Fig. 7c shows another girder type 9" which is intended for parts of the conveyor track where there is no drive of the drive carriage.

Fig. 8 illustrates a portion of a switching point in perspective. At this switching point, there is arranged a straight girder part 9 corresponding to the one according to Fig. 7a, which continues straight on after the switching point. A branched, curved girder 9a also connects to the switching point and is, in the example shown, of the same cross-section as the girder in Fig. 7a, but the girder 9a could also have the cross-section shown in Fig. 7c. Moreover, at the switching point there is arranged a girder 9' which is of the cross-section shown in Fig. 7b. In a plate 28 attached on top of the girder 9' there is a guide for a tie rod 29, by which the lower part of the girder 9' can be displaced to the left in the Figure, while at the same time a curved lower girder part 9b is pulled in so that its front end will be aligned with the upper part of the girder 9' while its rear end will be exactly aligned with the front end of the curved girder 9a.

At a switching point of this type, the drive carriage can pass straight on, i.e. from the girder 9' to the girder 9 when the girder 9' is in the shown position. However, when the lower part of the girder 9' has been displaced in the lateral direction and replaced by the girder part 9b, the front carrier of the drive carriage will by means of guide strips (not shown) or the like, which can be actuatable manually or by remote control to achieve that the driver pin is disconnected from the drive belt, by these strips being made to actuate the spring-biased driver pin 19 so as to be disengaged from

the hole 23 in the drive belt. Now the carrier positioned in the lower part of the girder and disconnected from the drive belt, which continues straight on in the upper part of the girders 9' and 9, can follow the curved track described by the girder part 9b. By the rear carrier 15 of the drive carriage being located a distance behind the front carrier 14, the rear carrier will still be engaged by its driver pin 19 in a hole 23 in the drive belt and thus move the front carrier into the track 9b. After the 10 girder 9a together with the girder 9b there is a girder portion (not shown) with a new drive of a corresponding drive belt extending in the new direction, and by the guide strip here being eliminated, the springs 24 of the driver pin will again press the driver pin 19 upwards 15 into driving engagement in a hole 23 in the new drive belt in the new direction. When the rear carrier of the drive carriage reaches the guide strips in the disconnected portion, the rear carrier will correspondingly be disconnected from the first drive belt and "follow" the 20 first carrier in the new direction.

Fig. 9 illustrates the drive in connection with the girder 9c being bent in a curve. Like in Fig. 1, there is a drive motor 1 which via a positive drive belt (not shown) transfers its drive force to drive a drive belt 25 by means of the gear drives 2, 3.

It is obvious that the drive belt cannot follow the curvature of the girder, but one drive belt ends where the first frame yoke 8 is positioned, and after the curve there is a second frame yoke 8' which, of course, can 30 support a motor for driving a new belt portion, but as illustrated in the Figure can also be driven by a flexible shaft 30 extending between the two frame yokes 8, 8' and thus transferring drive force from the motor 1 of the first frame yoke 8.

35 Like in connection with switches as described and illustrated with reference to Fig. 8, there is thus a distance where one carrier of the drive carriage has no

drive, and this implies, of course, that the distance between two such drive rollers for the drive belts is not allowed to be greater than to allow always one of the carriers of the same drive carriage to be engaged  
5 with a driving belt.

In an alternative embodiment of the carrier 14, 15, as shown in Fig. 10, the driver is not a pin 19 but a friction driver 31. This has an essentially flat upper surface adapted to be brought into frictional engagement  
10 with the drive element. In this case, the drive element is preferably formed with an essentially flat surface facing the carriage and consists, for instance, of a belt or a positive drive belt.

Since the necessary movement to bring the friction  
15 driver 31 out of contact with the drive element is smaller than in the construction shown in Fig. 4, the disconnecting function of the carriage in Fig. 10 can advantageously be designed in a slightly different way.

The lower part of the friction driver 31 is, at  
20 least on one side, provided with projecting portions 32 which extend transversely to the conveying direction. The portions can be provided with rolls 33 or other friction-reducing means. As shown in Fig. 11, moreover the rear carrier 15 of each drive carriage is provided with a  
25 fork-like depressing means 34, the ends thereof being bent slightly upwards. When two carriers approach each other, the ends of the fork 34 grasp one or both sides of the lower part of the driver 31 and force the projecting portions 32, and thus the entire driver, downwards.

30 It should be noted that the shown two embodiments of drive exhibit different properties. While a pin 19 engaging in a hole 23 in the drive element results in great transmission of forces, and a well-defined movement, it implies at the same time that outer forces that  
35 act on a carriage are propagated directly to the drive. The friction driver 31 results on the other hand in a smaller and less precise movement, but allows at the same



time a certain possibility of sliding, if for instance a carriage bumps into something.

In a preferred embodiment of the invention, each carriage is therefore provided both with a driver pin 19 adapted to be inserted in a hole 23 in the drive element, and a friction driver 31 as illustrated in Figs 12 and 13.

In Fig. 12, the carriage has two separate, spring-loaded drivers 19 and 31. One of these, for instance the rear one, consists of a carrier pin 19, while the other, for instance the front one, consists of a friction driver 31. Both drivers 19 and 31 can be engaged with and disengaged from the drive element 5.

The pin 19 is preferably in its lower part provided with projecting portions 36 in the same way as shown in Fig. 10, but extends, at least on one side, further away from the pin 19. A guide means 37 intended for the purpose, such as an inclined rail extending along a distance of the track, can be arranged to force, in cooperation with the portion 36, the pin 19 downwards and bring it out of contact with the drive element. Since the portion 36 extends further away from the pin 19 than the portions 32 of the friction driver, the guide means 37 can be adjusted not to actuate the friction driver 31. Conveniently the carriage is in connection with the pin 19 provided with a locking means 38, such as a hook, which can hold the pin 19 in a depressed position when the guide means 37 has been passed. The friction driver 31 can be disconnected, as described above with reference to Fig. 11.

In another embodiment, the driver 39 is a combination of pin 19 and friction driver 31. The friction driver 31 consists of a plate 40 provided with a hole 41, through which the pin 19 can run. The plate 40 is pressed by a spring 42 towards the drive element 5. Another, smaller spring 43 contained inside the spring 42 exerts a load on the pin 19. The plate 40 is in contact with the

driver lower part which is provided with projecting portions 32 which can be used to press down the plate 40 out of contact with the drive element.

If the plate is in contact with a smooth drive element, such as a drive belt, the pin 19 will be held on the same level as the plate 40, in engagement with the drive belt. If, on the other hand, the drive element has recesses, such as holes in a belt, or a distance between links in a chain, the pin will be pressed by the spring 43 up through the recess and thus engage the drive element.

In a case where it is not desirable for the pin to continuously engage the drive element, the lower part of the driver can instead be connected to the pin 19, in another embodiment (not shown). The pin 19 can then be provided with a flange adapted to engage the plate as the pin 19 is being pressed down a distance. This means that the arrangement has three different operational positions. In a first position, both the pin 19 and the plate 40 are pressed upwards by their respective springs 42, 43, the plate in contact with the drive element 5 and the pin in engagement with a possible hole 23. In a second position, the pin 19 has been pressed down by being actuated by the portions 32 and brought out of contact with the hole 23. However, the plate 40 is not affected by this movement and is held in contact with the drive element 5 by the spring 42. In a third position, the pin 19 has been pressed down yet another distance, so that the flange has engaged the plate and, while moving, brought this along. Thus, also the friction driver has lost contact with the drive element 5, and the carriage is completely disconnected.

The most projecting portion 36 can be used for a disconnecting mechanism as shown in Fig. 14. The rear carriages 52a, b, c are here of the type as shown in Fig. 13, while the drivers of the front carriages 53a, b are without the peripheral portion 36. Along the part

of the track where disconnection is to occur, a rail 50 is arranged under the track to engage the portion 36. The rail has a bevelled edge 51.

In the same way as described above with reference to Fig. 12, the edge 51 of the rail will press down the drivers of the rear carriages 52a, b, c while the front carriages 53a, b continue driving. When a front carriage 53b is made to run against a stationary rear carriage 52c, the depressing means 34 of this stationary carriage will cause disconnection of the front carriage 53b, whereby the entire drive carriage 43 is disconnected.

With regard to the different properties of the driving principles (a pin in engagement with a hole and friction, respectively), it may be convenient to use a flat drive element 5a along essentially flat portions of the drive track, and also a drive element 5b, provided with holes, along sloping portions. This is shown in Fig. 14, where carriages of the type shown in Fig. 13 (combined driving arrangement) are used.

The pin 19 will along the drive element 5a abut against the drive element without making engagement. In the transition to the drive element, the pin will be raised so as then to be pressed down again by the deflecting roller. Subsequently the friction driver will again drive the carriage by frictional engagement with the drive element 5b. Since the track is here sloping, it is however possible that the friction driver cannot on its own transfer sufficient forces to propel the carriage. The drive belt 5b will then slide, until the next hole 23 passes the pin 19, which is then pressed up in engagement with the hole and takes over propulsion.

The invention is not restricted to the embodiments illustrated in the Figures and described in connection therewith, and modifications and variants are possible within the scope of the appended claims. Thus, the girder 9 in the form of a box girder has been shown to have an upper inner space that holds the drive belt, while the

inner space for the carriers of the drive carriage is positioned under the upper space. However, the drive belt space could also be placed beside the space for the carriers, in which case, however, the carrier pins would be  
5 arranged horizontally.